DUAL CHANNEL PLUG-INS
TYPES 500,600,700

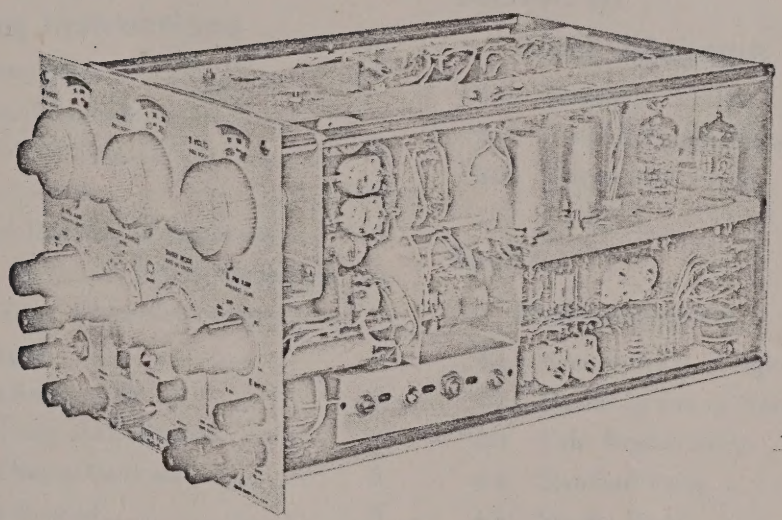
B-24

ANALAB INSTRUMENT CORPORATION

FAIR RADIO Sales
P.O. Box 1105
Lima, Ohio
45802

INSTRUCTION MANUAL

TYPES 500, 600, 700
DUAL CHANNEL PLUG-INS



TYPE 700 HIGH-GAIN PLUG-IN

This Instruction Manual is shipped with:

Type 500, Serial No. _____

Type 600, Serial No. _____

Type 700, Serial No. _____

Analab INSTRUMENT CORPORATION

ANAlytical LABoratory Instruments for Science and Industry

30 CANFIELD ROAD, CEDAR GROVE, ESSEX COUNTY, NEW JERSEY, U. S. A.

AREA CODE 201 — CE 9-6500

Cable Address: ANALAB

CONTENTS

Section I

Specifications

Page

1-1. Specifications 1

Section II

Operating Instructions

2-1. General Description 3
2-2. Controls and Terminals 3
2-3. A and B Preamp Controls 3
2-4. Volt Range Control 3
2-5. Null Balance Readout of Amplitude 3
2-6. Bandwidth Selector and Noise Reduction 4
2-7. Preamp Selector, Unbalanced Input 4
2-8. Balanced Input 4
2-9. DC Balance Adjustment 4
2-10. Amplifier Modes of Operation 4
2-11. Trigger and Sweep Controls 5
2-12. Time Range Control 5
2-13. Null Balance Readout of Sweep Time 5
2-14. Sweep Mode Control 5
2-15. Armed Single Sweep 5
2-16. Manually Triggered Sweep 5
2-17. Auto Sweep 5
2-18. Driven Sweep 5
2-19. Off Position of Sweep Mode; Electronic Shutter Application 5
2-20. Variable Length and Variable Rate Control 5
2-21. Variable Length Control 6
2-22. Variable Rate Control 6
2-23. Expanded Sweep 6
2-24. Trigger Source Control 6
2-25. Trigger Level Control 6

Page

2-26. Trigger Slope Switch 6
2-27. External Trigger Input 6
2-28. Amplitude Calibrator 6
2-29. Simplified Operation 6

Section III

Block Diagram

3-1. General 8
3-2. A and B Preamplifiers 8
3-3. Trigger and Sweep 8

Section IV

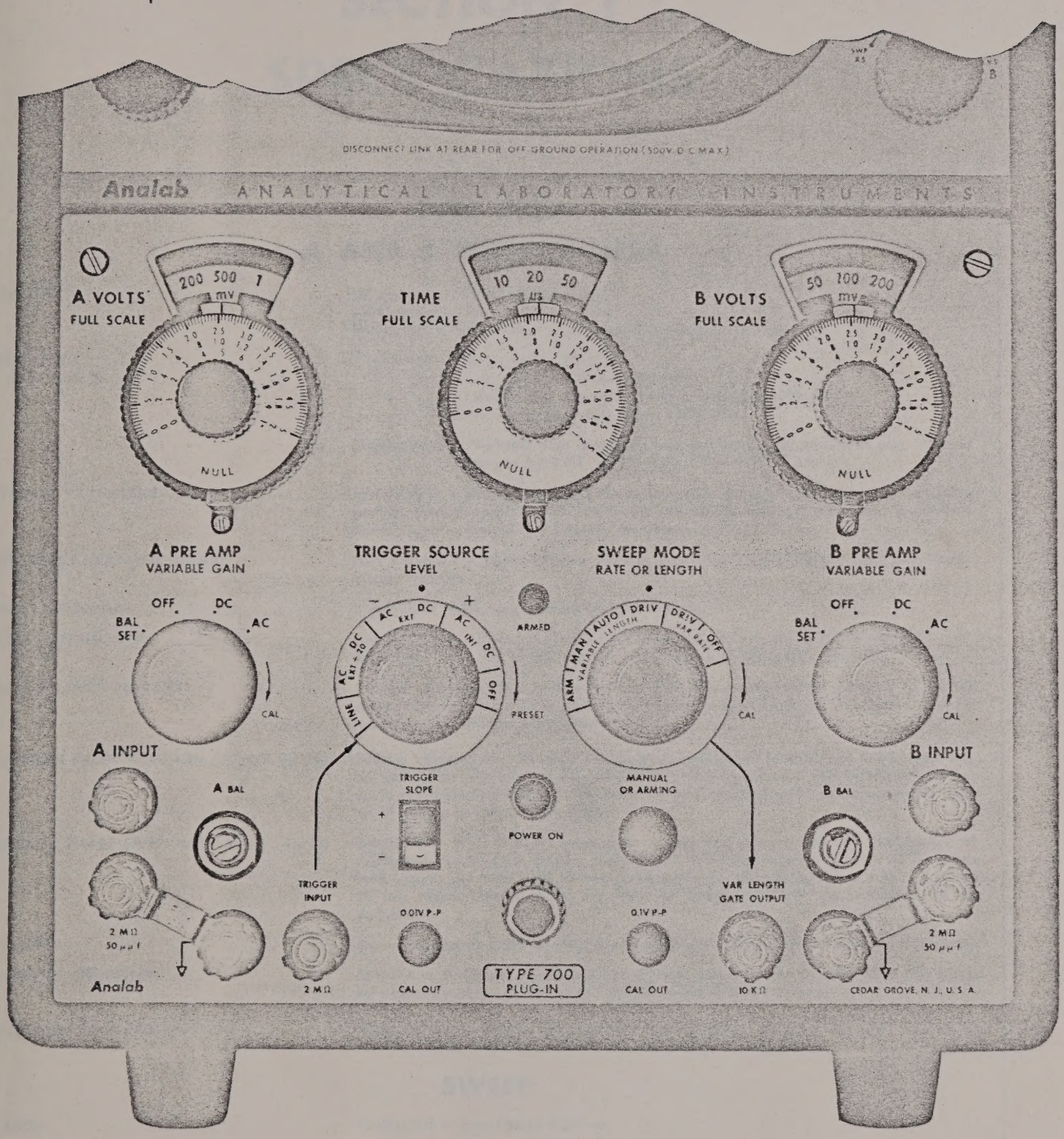
Maintenance

4-1. Removal of the Plug-in 10
4-2. Operating Out of Main Frame 10
4-3. Tube Replacements 10
4-4. Standard Parts 10
4-5. Special Parts 10
4-6. Test Procedure 11
4-7. Terminal Board Layout 16
4-8. Replacement Parts 19
4-9. Type 500 X-Y Plotter 22
4-10. Type 600 Dual-Channel Plug-in 22
4-11. Type 600, Parts Peculiar 22
4-12. Schematics 23-27

Section V

Warranty and Repairs

5-1 Claim for Damage in Shipment 29
5-2. Warranty 29
5-3. Returning Instruments for Repair 29
5-4. Shipping 29



FRONT PANEL VIEW OF TYPE 700

SECTION I
SPECIFICATIONS

TYPE 700
A AND B PREAMPLIFIERS

BANDWIDTH ..... DC coupled — DC to 150 KC (3db)
AC Coupled — 5cps to 150 KC (3db)
Bandwidth is independent of calibrated volt-range settings.

SENSITIVITY (with main frame) ..... Calibrated — 100 μv/cm to 20 v/cm.
1 mv to 200 V full scale (10 cm)
17 calibrated attenuator ranges, accurate within ±1%.
Scale illuminated only when calibrated.

Uncalibrated — Variable gain control permits continuous adjustment of gain between ranges by 2.5:1, or 2.5 mv to 500 volts full scale.

VERTICAL EXPANSION ..... Symmetrical signal, producing 3 times full scale display, may be viewed and any portion thereof positioned on screen without visible amplifier distortion. A unidirectional signal is limited to 1.5 screen diameters.

INTERNAL CALIBRATOR SIGNAL ..... 0.01 V and 0.1 V, approximately 1000cps squarewaves, available at front panel jacks. Accuracy ±2%.

INPUT IMPEDANCE ..... 2 megohms ±2%, unbalanced; 50 μμf nominal.

INPUT CONNECTIONS ..... Unbalanced — All ranges 1 mv — 200 volts full scale — AC or DC coupling.
Balanced — 1 mv to 200 mv full scale ranges — AC or DC coupling.

NULL BALANCE READOUT ..... Calibrated null balance system incorporates direct readout dials accurate to 1% full scale. Null readout axis is scribed with anti-parallax lines on illuminated scale in main frame to eliminate parallactic reading error.

COMMON MODE REJECTION (DC COUPLING) ..... Factory adjusted at 1 KC on 1 mv range to a rejection in excess of 2000. CMR may be optimized with internal adjustment for other frequencies and attenuator ranges up to and including 200 mv. Maximum common mode signal — 5 volts zero to peak or 10 volts p-p, symmetrical signal.

RELATIVE PHASE SHIFT (WITH MAIN FRAME) ..... Less than 2° from 0-30 KC when both signals are connected to any combination of calibrated ranges from 50 mv to 200 volts. Also less than 2° from 0-30 Kc when both signals are connected to any combination of calibrated ranges within 1 mv to 20 mv. Measurements made at center of screen and with maximum of 10 cm deflection.

POLARITY ..... Signal may be inverted in either preamplifier to facilitate comparative measurements.

MODE OF OPERATION ..... Either A or B channel signals may be plotted against sweep or each other (x-y plots) by proper positioning of Display Function switch in main frame.

FRONT OR REAR CONNECTIONS ..... When plug-in is used in rack-mounted frames, signals may be connected to front or rear terminals, with input selected by slide switches in plug-ins.

SWEEP

RANGE ..... Calibrated — 5 sec/cm to 1 μs/cm.
50 sec to 10 μs full scale (10 cm).
22 calibrated ranges. Sweep timing capacitors and resistors ±1%, except on slow and high sweep ranges where variable adjustments set time constants against external precision standards.
Scale illuminated only when calibrated.
External capacitors may be connected to sweep for slower ranges.

Uncalibrated — Vernier permits continuous adjustment of sweep time between ranges by 2.5:1 or 120 sec to 10 μs full scale.

EXPANSION ..... 5x calibrated sweep expansion on all ranges. Extends fastest sweep to 0.2 μs/cm.

section I — specifications

MODES OF OPERATION ..... Driven, calibrated or variable uncalibrated.
Auto.
Manual (push-button operation to trigger sweep and provide contacts for synchronizing external equipment).
Armed, single sweep.
Sweep and gate may be synchronized during X-Y plots to turn beam on for calibrated selected period of time or may be shut off, with gate resting in "on" position.

VARIABLE LENGTH GATE OUTPUT ..... Positive 5 volt gate available at front panel terminal. Rise time of gate is coincident with start of sweep. Fall time may be delayed from 1 μsec to 50 sec., continuously calibrated. Variable length gate may be used as delaying trigger for external oscilloscope or as start-stop signal for digital electronic counters.

SAWTOOTH VOLTAGE OUTPUT ..... Available at rear terminal of main frame. 1 volt p-p approx., 1 K output impedance.

NULL BALANCE READOUT ..... Calibrated null balance system incorporates direct readout dial accurate to ±1% full scale. Null readout axis is scribed with anti-parallax lines on illuminated scale in main frame to eliminate parallactic reading error.

TRIGGER CIRCUITS

COUPLING ..... AC or DC, internal and external.

SOURCES ..... Internal.
External.
External attenuated (20:1).
Line.
Off.

SENSITIVITY ..... Internal — 0.5 cm to 150 kc.
External — .25V to 150 kc.

POLARITY ..... Positive or negative triggering selected by front panel switch

TRIGGER LEVEL ..... Provided by front panel control with a preset position.

MECHANICAL SPECIFICATIONS

DIMENSIONS ..... 8½" wide, 7" high, 13¼" deep.

WEIGHT ..... 15 pounds unpacked. Shipping weight: 20 pounds.

FINISH ..... Satin aluminum front panel, with color coded controls and terminals.

TYPE 600

Specifications identical to Type 700 except for B channel.

B CHANNEL (WITH MAIN FRAME): ..... **Bandwidth** — DC — 500 KC (3 db) at max. sensitivity.
Sensitivity — 40 mv/cm max. Gain adjusted by uncalibrated variable potentiometer.
Input — Balanced or single-ended through 250 K potentiometer.
Vertical Expansion — Three times full screen expansion with positioning over the entire range.

TYPE 500

Specifications identical to Type 700, except that trigger and sweep circuits are not incorporated.

See Page 22 for description and parts peculiar to Types 500 and 600.

SECTION II
OPERATING INSTRUCTIONS

2-1. GENERAL DESCRIPTION

The Type 700 is a dual channel, high-gain plug-in designed to operate with Analab low frequency oscilloscope main frames. It features precision null balance readout on both amplifier channels and sweep. Extremely high gain, stable preamplifiers permit accurate measurements of signals as low as 20 microvolts. Virtually automatic synchronization is achieved with stable triggering and excellent lock-out circuits. Operation is greatly simplified by use of preset controls for most applications. A variable length gate output permits delayed synchronization of external equipment.

2-2. CONTROLS AND TERMINALS

Operating controls and terminals for the Type 700 are on the front panel. Internal slide switches in the A and B preamplifiers permit front or rear input connections for signals when the plug-in is used in rack-mounted main frames. The functions of each control and terminals are outlined below.

2-3. A AND B PREAMP CONTROLS

The A and B channel controls and terminals are identical. A channel controls and terminals are color coded in green, while those in the B channel are coded in blue. Each channel has a Volt Range Control, a Null Readout dial, a Preamp Selector for coupling and polarity, a Variable Gain control, DC balance adjustment, and three input terminals for unbalanced or balanced input.

2-4. VOLT RANGE CONTROL

Selects ranges from 1 mv to 200 volts full scale. Dial is illuminated and ranges are calibrated only when Variable Gain control is in clock-wise detented position.

2-5. NULL BALANCE READOUT OF AMPLITUDE

1. Set Null Readout control to zero.

2. Select any volt range to give a convenient size pattern. The null readout system is in calibration only when the variable gain control is in the preset position and the range dial is illuminated.

3. With the Y Position Control in the main frame set the bottom of the waveform on the horizontal null axis at the center of the illuminated scale. This is an anti-parallax line and permits alignment of the bottom of the waveform without parallactic error. The anti-parallax facility is equivalent to a mirror-backed scale on a meter. To make repeatable, accurate readings with the anti-parallax scale:

   a. First move the eye up and down until a position is reached where the double scribed null axis lines overlap. If the scale is illuminated, light cancellation will be noticed for the proper position of the eye. With the eye in the proper reading position, set the bottom of the waveform to the null axis with the Y Position Control.

4. Holding the eye in the same position, adjust the previously zeroed null readout control until the top of the waveform moves to the null axis.

5. Read the null dial and position the decimal point according to the number of significant figures showing on the Volt Range selector. In reading the null dial note that there are three scales, 0 to 1.0, 0 to 2.0, and 0 to 5.0. Use the null readout scale corresponding to the range showing in the Volt Range window. These ranges are in 1, 2, 5 sequence.

6. The above procedure applies to positive going signals. To read a negative signal invert signal with preamp selector switch.

Several examples will illustrate the method:

Suppose the Volt Range selector reads 1 mv and the null dial reads 0.815 on the 0-1 scale. The peak to peak reading of the waveform is therefore 0.815 mv.

If the Volt Range selector reads 10 mv, then the answer is 8.15 mv. If the Volt Range selector reads 100 mv, the answer is 81.5 mv. Now suppose the Volt Range selector is on 5 volts. Read the null dial directly on the 0-5 scale. If the Volt Range selector is on the 50 volt range, move the decimal point reading on the null dial one place to the right.

Any peak to peak waveform, or any portion thereof may be read easily and accurately with the null readout system. The null balance technique and anti-parallax scale eliminates the parallactic errors in conventional oscilloscopes when analog waveforms are measured from the face of a cathode-ray tube. Repeatable, accurate, direct readings may be made without interpolation. Furthermore, deflection errors inherent to cathode-ray tubes and deflection amplifiers, which contribute to measurement errors in conventional oscilloscopes, are eliminated with the null balance technique.

The null readout system may be used to advantage to scale data very precisely from photographic recordings. In conventional oscilloscopes parallactic errors in the camera optical system and distortions in the CRT, deflection amplifiers and camera lens cause errors of several percent if measurements are made by scaling a photograph of the trace with respect to the illuminated scale. To eliminate these errors, first multiple-expose a series of ten horizontal lines, spacing them equally with the ten integral numbers on the null dial. Repeat with a vertical line using the sweep time null dial for positioning. Then expose the trace. All the errors enumerated above will then be eliminated in scaling the trace to the grid pattern made with the multiple exposure of a vertical and horizontal line.

2-6. BANDWIDTH SELECTOR AND NOISE REDUCTION

The full 150 kc bandwidth of the amplifiers in the Type 700 is maintained for all volt ranges. At the maximum sensitivities, the high frequency thermionic noise in the tubes may be reduced by narrowing the bandwidth. This is done for the A and B channels by throwing slide switches in the main frame. For narrow-band operation, the bandwidth is approximately 10 kc. Further reduction of noise may be effected by reducing the bandwidth still more if the application permits it. This is done by increasing the value of the capacitors, C305 and C405, on the bandwidth slide selector switches.

Because of the very high gain of the preamplifiers, shielded leads and conectors should be used at the maximum sensitivities to eliminate external noise pick-up. Ground connections should be very clean and tight to eliminate hum.

2-7. PREAMP SELECTOR, UNBALANCED INPUT

AC or DC coupling for either normal or inverted appearance of the signal on the screen is selected with this control. The ability to invert either the A or the B signal facilities comparison measurements of signals on each channel. An OFF position on this control disconnects the signal from the amplifier without removing the signal from the input terminals. The OFF position is used in conjunction with the BAL SET position to set the DC balance of the preamplifier.

Unbalanced signals with respect to ground are observed by feeding them to the A or B input terminals, with the link closed to circuit ground.

2-8. BALANCED INPUT

AC or DC coupling is provided for balanced signals. For balanced signals, open the link between the lower input binding post and circuit ground. Calibrated ranges up to 200 mv full scale may be used for observing balanced signals. This signal handling range may be extended by using the variable gain control which raises the level to 500 mv full scale. Since the amplifiers will handle up to 3x full scale deflection with positioning over the entire range, expanded, balanced signals up to 1.5 volts maximum may be observed.

If the desired balanced signal has a high level DC component (500 volts DC max.), use AC coupling to block the DC signal. Matched polystyrene blocking capacitors are provided on AC coupling for good balanced operation. With the high DC component thus eliminated, the amplifiers can then accept up to 1.5 volts of balanced AC signal. The low frequency response of the AC amplifier is 3db down at 5 cps.

2-9. DC BALANCE ADJUSTMENT

Unbalance of the preamplifier will be manifested by a depositioning of the trace as the Volt Range selector is varied. To rebalance, set the Sweep Mode selector to AUTO, the Preamplifier Selector to OFF. Center the trace with the Y position control. Now turn to the BAL SET position. If the trace depositions, restore it to center with the Balance Adjustment on the front panel. If the trace has moved off scale, turn on the Beam Finder to locate it while making the balance adjustment or turn the attenuator to a high attenuation range. If the latter is done increase sensitivity as the system is brought into balance.

The DC balance control is a backlash arrangement combining coarse and fine potentiometers. First use the coarse control to approach center and then work over the backlash range for fine adjustment. Large slotted, extended shafts are used for these controls to permit their setting with a small coin if a screwdriver is not readily available.

The DC balance may have to be reset over prolonged periods of measurement, or whenever the instrument is turned on. It is best to allow the instrument to warm up at least 15 minutes before resetting the DC balance, unless the balance is too far off to center the trace with the Y position control when the equipment is first turned on. In this case set the DC balance upon start-up and rebalance about 15 minutes later.

2-10. AMPLIFIER MODES OF OPERATION

When the dual channel Type 700 is used with single trace main frames, either channel may be plotted against time by manually selecting the channel with the Display Function switch in the main frame. The same Function control permits X-Y plotting of the signals on both channels against each other. When the Type 700 is used with dual-trace main frames, both signals may be presented independently or simultaneously. The use of independent preamplifiers permits widely different signal amplitudes to be compared by applying one signal to A channel and one to B channel and properly adjusting individual attenuators.

2-11. TRIGGER AND SWEEP CONTROLS

The Sweep Time control, Trigger Source selector, Sweep Mode control, Level control, Slope switch, Variable Sweep length and Sweep Rate controls and related terminals are color coded in lavender and provide a logical functional grouping.

2-12. TIME RANGE CONTROL

22 calibrated sweep ranges are selected with this control, ranging from 5 sec/cm to 1 μs/cm. The sweep time window is lit when the sweep time is in calibration. The sweep is in calibration for all sweep modes, except when the Variable Rate control is out of its preset position. A 23rd position on this switch is for an external capacitor that may be used for slower sweeps. Rear terminals on the main frame are provided for connection of this capacitor. A good quality polystyrene capacitor is recommended for best linearity. The sweep time will be increased about 50 seconds per microfarad.

2-13. NULL BALANCE READOUT OF SWEEP TIME

This control is used in the same manner as the null readout controls in the A and B preamplifiers, described in section 2-5. In measuring rise times, duration of signals, or time between pulses, the vertical null axis is used. With the null dial at zero, first set the start of the waveform on the null axis with the X postiion control. Then move the other reference point in the waveform to the null axis with the readout control. Read time directly on the correct scale.

2-14. SWEEP MODE CONTROL

Armed single sweep, manually triggered sweep, auto sweep, calibrated driven sweep of fixed calibrated length or calibrated variable length, and uncalibrated variable-rate driven sweep are the modes in which the sweep may be operated.

2-15. ARMED SINGLE SWEEP

For this mode of operation push the arming button and observe that the arming light is lit. The first signal that is then fed to the trigger circuits will fire the sweep, which will then remain disabled until re-armed. The armed sweep is ideal for observing or photographing signals that do not repeat themselves from one cycle to the next.

2-16. MANUALLY TRIGGERED SWEEP

In some applications it is desirable to start external equipment or a system, of which the oscilloscope is a part, from a single trigger point. The manual sweep mode permits this. Depressing the push button fires the sweep once and simultaneously closes a set of electrically isolated contacts, whose connections are made available at rear terminals on the main frame. No trigger voltage from the scope appears on these contacts. They are intended to become part of the user's triggering system.

2-17. AUTO SWEEP

In this mode the sweep free runs at approximately 40 cps in the absence of a triggering signal. When a signal is fed to the scope, it automatically locks the sweep. The auto sweep mode is useful for establishing a zero reference level before applying signals, or to obtain a horizontal trace in the absence of signal. In this position there is no level selection and the triggering system is at maximum sensitivity. With the Type 700 plug in at full sensitivity and bandwidth there may be spurious sweeps initiated by noise.

2-18. DRIVEN SWEEP

This is the most stable and recommended mode of operation for most signals. No trace appears on the screen in the absence of signal but most waveforms are observed and automatically locked in when signals are fed to the trigger circuits, either internally or externally, and if the level control is in preset, with the triggers AC coupled. There are three driven sweep modes of operation. In one mode the sweep time is always calibrated and fixed length. In the second mode it is calibrated and variable in length. In the third driven mode the sweep is uncalibrated and variable in rate when the Variable Rate control is taken out of the preset position.

2-19. OFF POSITION OF SWEEP MODE — "ELECTRONIC SHUTTER APPLICATION"

In the OFF position, the sweep and beam gate signals are inoperative and the gate rests at a level which automatically presents a spot on the screen without having to reset the Intensity Control. This is desirable when switching to X-Y plots and also permits a narrower range intensity control with finer action.

In some X-Y plots, it is desirable to keep the beam gate running to strobe the trace or turn it on for a finite length of time. This can be done by internally or externally triggering the sweep in either the armed, manual, auto, or driven modes. The time that the beam turns on or strobes the trace is read directly from the Time Range dial when the length is set exactly 10 cm. With the ability to vary the length any width of strobe can be set. If it is desired that the gate not operate during the X-Y plot, the Sweep Mode control should be turned to OFF.

2-20. VARIABLE LENGTH AND VARIABLE RATE CONTROL

The same knob performs two functions. It varies sweep length or rate, depending upon the setting of the Sweep Mode control.

2-21. VARIABLE LENGTH CONTROL

In the calibrated armed, manual, auto and driven modes the sweep length may be varied from 1 cm to full scale. This in no way affects the time/cm calibrated rate of the sweep. The Variable Length control has three functions, (1) to furnish a delaying trigger for external equipment, (2) to facilitate synchronization of complex waveforms, while still maintaining sweep calibration and (3) to provide a calibrated variable width strobe for X-Y plotting.

As the sweep length is varied, a positive variable length gate may be taken from the Gate Output terminal to synchronize other equipment. The rise time of the gate signal is coincident with the start of the sweep, the fall time with the end of the variable length sweep. This gate signal may be used to trigger a second oscilloscope externally to observe a delayed portion of the signal in expanded form. To do this:

a. Feed the same signal to both oscilloscopes.

b. Trigger the second oscilloscope on external trigger using negative sync polarity and deriving the trigger from the gate output of the first.

c. The sweep length control is varied to "tag" the portion of the waveform to be observed in delayed and expanded form. Tag the waveform by shortening the sweep until it ends just before the desired cycle to be observed on the second scope.

d. On the second scope, the tagged cycle will then be observed as the first cycle on the screen. The sweep time of the second scope may now be set to expand the desired cycle in detail.

e. The delay time may be measured by scaling the time duration of the shortened sweep on the first scope, or more precisely with the Null Readout. Calibrated delays from 1 μs to 50 seconds may thus be obtained.

The rise and fall time of the variable length gate signal may be used to start and stop a digital electronic counter so as to measure a finite time duration of the waveform, as observed on the scope, in digital form on the counter.

2-22. VARIABLE RATE CONTROL

Uncalibrated variation of sweep rate on any range may be obtained with the Variable Rate control which changes the rate by approximately 2.5:1 over its range.

2-23. EXPANDED SWEEP

A 5x calibrated expansion of the sweep on all ranges may be obtained for the signal on either the A or B channel by proper positioning of the Display Function switch in the main frame.

2-24. TRIGGER SOURCE CONTROL

The sweep may be synchronized from either the power line, AC or DC coupled external signals (directly or attenuated 20:1), or AC or DC coupled internal signals. The modes of triggering are selected by the Trigger Source control. An OFF position establishes the zero sync reference level.

AC coupled internal sync is recommended whenever the application permits as the simplest mode of operation.

DC coupling is desirable particularly for very slow sweep applications, but the user is cautioned to note that when internal DC sync is used, any movement of the Y Position control or Null dial changes the level of triggering and the pattern may fall out of synchronization. The Trigger Level must then be reset.

2-25. TRIGGER LEVEL CONTROL

The Trigger Level control determines the level of the waveform at which the sweep is synchronized. The leveling action operates for AC or DC coupling of the trigger signal. The leveling is disabled for Auto Sweeps. A preset position on the Trigger Level control sets the trigger circuits in a sensitive mode of operation that permits automatic triggering on almost any waveform fed to the scope. Use the variable level control only when necessary.

2-26. TRIGGER SLOPE SWITCH

This switch selects the polarity of signal fed to the trigger circuits.To invert a signal and maintain the same triggering point it is necessary to operate both the Trigger Slope switch and the preamp selector control.

2-27. EXTERNAL TRIGGER INPUT

External trigger signals are fed to this terminal. Symmetrical signals between +10 volts and —10 volts amplitude may be fed externally with leveling action over this range. A 20:1 external trigger attenuator on the Trigger Source control extends the signal handling capabilities to ±200 volts.

2-28. AMPLITUDE CALIBRATOR

Two levels of an approximate 1000 cycle squarewave are available at pinjacks on the front panel. They are used to check the calibration of the Volt Range dial, the Null Readout system and the post amplifier gain. See Maintenance Section for recalibration of the A and B channels.

The squarewave signal is convenient for checking the transient response of the amplifiers or setting the compensation adjustments of the attenuators and external probes.

2-29. SIMPLIFIED OPERATION

Despite the great degree of complexity and versatility of the Type 700, its extremely stable trigger circuits and the preset positions of many of the controls permit

simplified operation for waveforms encountered in routine scope applications. The instrument may be operated as follows for most work:

1. Set the Variable Gain control to preset.
2. Set the Trigger Level control to preset.
3. Set the Trigger Source control on Internal AC.
4. Set the Sweep Length or Rate Control to CAL.
5. Set the Sweep Mode control to Calibrated Driven (or Auto).
6. Set the Preamp selector to AC coupling.

The scope will then synchronize automatically on most waveforms and the user need operate primarily the Position, Volt Range, Sweep Time and Null Readout controls in making qualitative and quantitative measurements.

SECTION III
BLOCK DIAGRAM

3-1. GENERAL

The Type 700 Dual Channel Plug-in consists of three major assemblies, (1) the A Preamplifier, (2) Trigger and sweep circuits, and (3) the B Preamplifier.

3-2. A AND B PREAMPLIFIERS

These are identical amplifiers. Each has a compensated input attenuator that feeds the signal to a balanced input stage. The balanced output is fed to a second balanced amplifier stage and cathode follower, followed by a second gain attenuator and cathode follower stage, whose output connects through plugs to the balanced first stage of the post amplifier in the main frame. A high degree of overall feedback is used to provide long time calibration accuracy. The second attenuator is balanced permitting fully balanced operation over the eight most sensitive ranges.

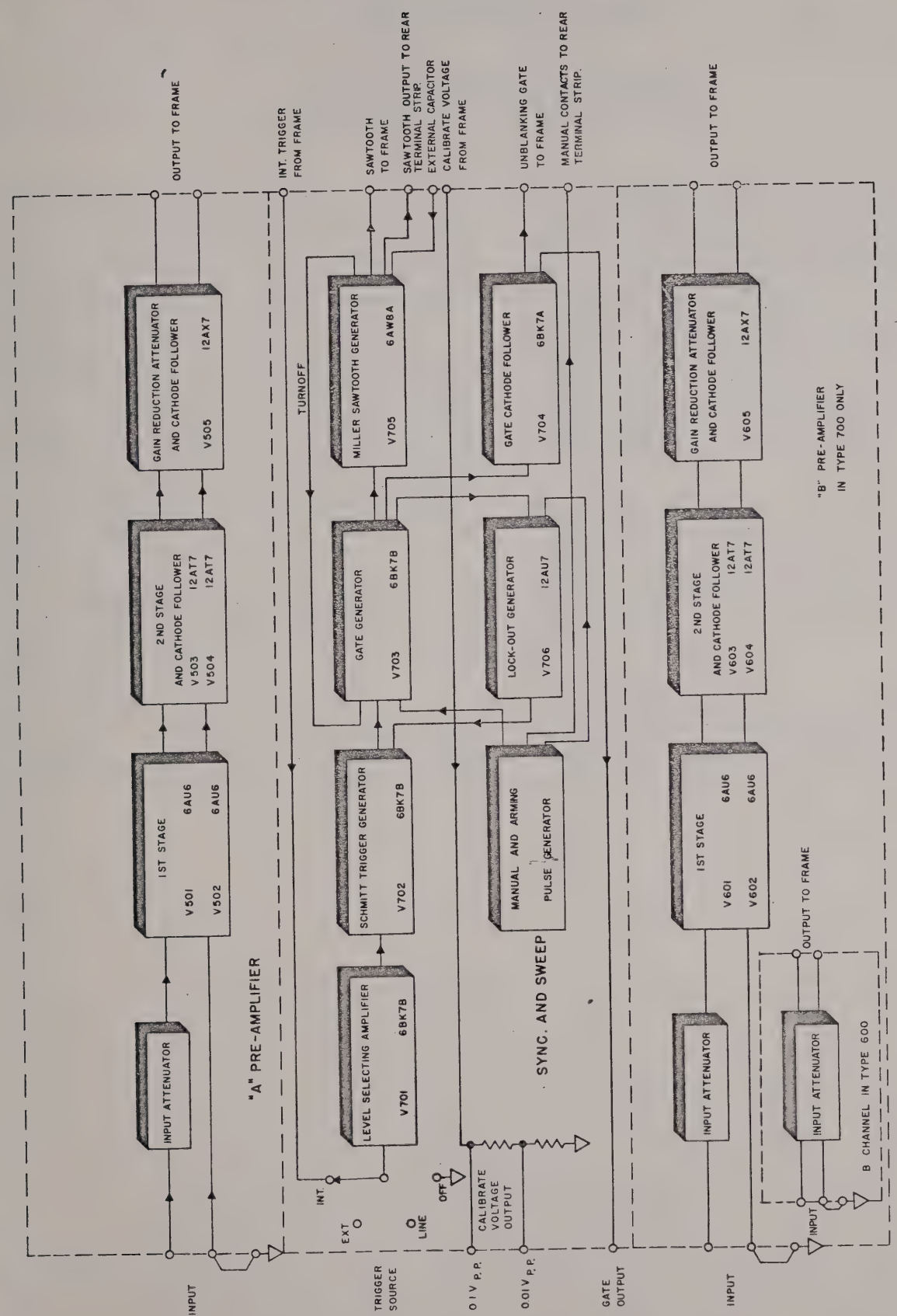
3-3. TRIGGER AND SWEEP

Internal triggers are obtained from the post amplifier and are supplied to a level selecting amplifier, whose output is converted to sharp triggers by a Schmitt Trigger Generator. These triggers in turn drive the Gate generator. Its outupt is DC coupled to grid of the cathode-ray tube to unblank it during the sweep time.

The Gate generator also turns on a Miller sawtooth generator. It produces a sawtooth voltage whose amplitude is determined by the sweep length control. At the selected level the saw generator feeds a turn-off signal to the Gate generator, returning the gate generator to its original state and terminating the saw. The sweep lock-out generator prevents triggers from interfering with the gate generator and saw until the saw has been completed and has returned to its resting point.

The variable length gate output is brought at low impedance to a front panel terminal through the Gate cathode follower.

The sawtooth voltage generated in the plug-in circuits is converted to a balanced saw, further amplified by the X post amplifier in the main frame, and coupled to the horizontal deflection plates of the CRT. The sawtooth voltage is also available as an output signal at a terminal on the rear of the oscilloscope main frame.



BLOCK DIAGRAM TYPE 700

SECTION IV
MAINTENANCE

4-1. REMOVAL OF THE PLUG-IN

To remove the plug-in from the main frame, open the gray locking knob at the bottom and pull it forward to release the connecting plugs. The entire assembly will then slide forward readily. When replacing the plug-in, be certain that the locking knob is tightened so as to assure proper mating of the connectors.

Before placing the Type 700 Plug-in into operation, remove the retaining cardboard spacers that restrict motion of the shock-mounted A and B preamplifiers during shipment. The shock-mounted chassis are temporarily fastened to the bulk-heads with red-painted screws. The cardboard spacers between the preamplifiers and shield plates in the plug-in should be removed after the retaining screws are taken out. Check to see that the shock mounted chassis float freely.

4-2. OPERATING OUT OF MAIN FRAME

Use Analab type 9001 Service Cable to operate plug-in out of main frame.

4-3. TUBE REPLACEMENTS

If the user should find the change in trace position objectionable when switching from channel A to channel B, he may wish to match the output 12AX7 cathode followers, V505 and V605, for best balance. Matched tubes may be obtained from Analab. A small percentage of 6AU6 tubes used for the input of the preamplifiers may fall beyond the range of the DC balance control. If the user has any difficulty in the field in replacing a 6AU6 in the balanced input stages and obtaining DC balance, he may purchase matched tubes from Analab. No matching or selection is required for tube replacements in any other stages.

It is recommended that amplifier input tube replacements be allowed to age for about 50 hours before recalibrating any circuits.

4-4. STANDARD PARTS

Standard parts can be purchased from Analab, its authorized service depots, or obtained locally. When ordering any part, please include all the information in the replacement part list and the type and serial number of the instrument.

4-5. SPECIAL PARTS

In addition to standard parts a number of special parts are made for Analab by other manufacturers. These are most readily obtained directly from Analab or its local service depot.

TEST EQUIPMENT:

Vacuum Tube Voltmeter.
Ballantine Type 420 Precision Voltage Calibrator or equivalent.
Tektronix Type 181 Time Calibrator or equivalent.
Berkeley Type 7370 Electronic Counter or equivalent.

Test	Trigger Source (Front Panel)	Level Control (Front Panel)	Slope (Front Panel)	Sweep Mode (Front Panel)	Length, Rate Control (Front Panel)	Sweep Time (Front Panel)	Sweep Readout (Front Panel)	Trigger Level Preset (Internal)	Trigger Sensitivity (Internal)	Stability 1 (Internal)	Stability 2 (Internal)	Sweep Length Preset (Internal)
Stability Adjustment Connect VTVM to Pin 3 or 8, V703. Rotate Stability 2 clockwise until multivibrator fires as indicated by free-running trace on screen or sudden drop in voltage as measured on VTVM. Read voltage that exists *just before* free-running condition. Note that this is a *negative potential* of approximately —55 volts. *(It will be different from one instrument to the next.)* Now go back to CCW position of Stability 2 and advance it so that it is *6 volts less* than free-running voltage of —55 volts, or —49 volts, as measured on VTVM. Now raise the voltage by 4 volts with Stability 1. In our example, this would bring us from —49 volts to —53 volts.	Off	Preset	+	Driven variable length	Preset	100 ms	0	Centered	c.c.w.	c.c.w.	c.c.w.	Centered
Trigger Sensitivity Adjustment Feed Ballantine calibrator signal (0.200 volts P-P) to A preamplifier and set volt range to 500 mv full scale. Also feed same signal to External Trigger terminal. Start with Trigger Sensitivity adjustment fully counter clockwise and front panel Trigger Level Control centered. Advance Trigger Sensitivity control a few degrees clockwise and then rotate Level Control about $\pm 5°$. If sweep does not fire, advance Trigger Sensitivity control a little further. Repeat procedure until sweep just occurs when Level Control is rotated back and forth a few degrees about its center. The Level Control has now been adjusted for its most sensitive operation.	External A.C.	Preset	+	Driven variable length	Preset	100 ms	0	Centered	c.c.w.			Centered
Trigger Level Preset Adjustment Adjust Trigger Level Preset until sweep occurs.	External A.C.	Preset	+	Driven variable length	Preset	100 ms	0	Centered				Centered

TRIGGER AND SWEEP CIRCUITS (Continued)

Test	Trigger Source (Front Panel	Level Control (Front Panel)	Slope (Front Panel)	Sweep Mode (Front Panel)	Length, Rate Control (Front Panel)	Sweep Time (Front Panel)	Sweep Readout (Front Panel)	Trigger Level Preset (Internal)	Trigger Sensitivity (Internal)	Stability 1 (Internal)	Stability 2 (Internal)	Sweep Length Preset (Internal)
Sweep Calibrator Adjustment Apply 1 ms pulses to A preamplifier from Tektronix Type 181 time calibrator. Adjust sweep calibration to obtain 10 pulses on 10 cm full scale. Repeat procedure on 1 ms to 0.5 sec full scale ranges and optimize adjustment for best mean value and calibration over these ranges.	Internal A.C.	Adjust for best sync	+	Driven variable length	Preset	10 ms	0					Centered
Sweep Length Preset Set sweep length to 11 cm.	Internal A.C.	Preset	+	Driven variable length	Preset	10 ms	0					
Fast Sweep 1 Apply 1 μs pulses. Adjust Fast Sweep 1 for 10 pulses full scale.	Internal A.C.	Preset	+	Driven variable length	Preset	10 us	0					
Fast Sweep 2 Apply 10 μs pulses. Adjust Fast Sweep 2 for 10 pulses full scale.	Internal A.C.	Preset	+	Driven variable length	Preset	100 us	0					
Sweep Readout Adjustment Index Readout Dial as follows: Turn readout shaft clockwise to stop. Loosen readout knob and dial. Set knob and dial so that the 2.85 (0-5 scale) mark on the readout dial is aligned with the right edge of the lower extension of the fiducial plate (below the large Time Range knob). Tighten screw. Set Readout Dial to 5.0. Apply 1 ms pulses to A Channel. With X Position control, set 10th pulse to first vertical cm mark. Turn Readout dial to 0.0. Adjust Readout adjustment to line first pulse with first cm mark. Repeat to touch up.	Internal A.C.	Preset	+	Driven variable length	Preset	10 ms	0					
Slow Sweep Adjustment Connect Berkeley counter to Variable Length Gate output terminal on scope. Set counter to start on leading and stop on trailing edge of gate output. Set sweep length to 10.0 cm. Adjust Slow sweep adjustment for 10.01-9.99 second count.	Internal A.C.	Preset	+	Auto	Adjust for 10 cm exactly	10 sec	0					

A AND B PREAMPLIFIERS

TEST EQUIPMENT AND ACCESSORIES:

Type 1100 Main Frame.
Ballantine Type 420 Precision Voltage Calibrator or equivalent.
Hewlett-Packard Type 211A Square Wave Generator or equivalent.

SET: Sweep mode — Auto
Trigger Selector — Internal A.C.
Level Selector — Preset

Test	A Input	A Volts Full Scale Attenuator	A Selector	B Input	B Volts Full Scale Attenuator	B Selector	Display Function	Sweep Time	Observation and/or Adjustment
Preliminary Adjustments		10 mv full scale	Off		10 mv full scale	Off	A vs sweep	10 ms	1. Set Sensitivity 2, common mode adjustment and C 611, 612, 613, 614, 511, 512, 513, 514 to approximate centers. (These capacitors are on terminal boards. See terminal board diagrams for location.) 2. Turn instrument on and allow 15 minute warmup. 3. D.C. balance A&B channels.
A Preamplifier Sensitivity Adjustment	100 mv p-p (Ball. Cal.)	200 mv	+A.C.				A vs sweep	10 ms	1. Adjust Sensitivity 1 (200 mv) to give 5 cm deflection at center of screen.
	10mv p-p	20 mv	+A.C.				A vs sweep	10 ms	2. Adjust Sensitivity 2 (20 mv) to give 5 cm deflection at center of screen.
									3. Repeat steps 1 and 2 once.
B Preamplifier Sensitivity Adjustment				100 mv p-p 10 mv p-p	200 mv 20 mv	+A.C. +A.C.	B vs sweep B vs sweep	10 ms 10 ms	1. Adjust Sens. 1 2. Adjust Sens. 2 3. Repeat 1 and 2
A Preamplifier Response	H.P. 211A Full scale 20 k.c. squarewave	20 mv	+A.C.				A vs sweep	100 usec	1. Adjust C513, C514 on terminal boards to obtain flattest possible top, keeping the two settings approximately the same. 2. Adjust C511, 512 on terminal board to obtain squarest possible corner without overshoot, keeping the two settings approximately the same. 3. Repeat steps 1 and 2 to obtain sharpest possible corner without overshoot while maintaining a flat top.

A AND B PREAMPLIFIERS (Continued)

Test	A Input	A Volts Full Scale Attenuator	A Selector	B Input	B Volts Full Scale Attenuator	B Selector	Display Function	Sweep Time	Observation and/or Adjustment
A Preamplifier Response Check	H.P. 211A Full scale 200 k.c.	20 mv	+A.C.				A vs sweep	10 usec	Measure risetime (10 to 90%) of square wave. Rise time should be no greater than 2 usec.
	Same	200 mv	+A.C.				A vs sweep	10 usec	Repeat above test.
B Preamplifier Response						+A.C.	B vs sweep		Repeat procedure for A Preamplifier Response using B Preamplifier input controls and adjustments.
A Attenuator Compensation	H.P. 211A 2 kc Full scale	500 mv	+D.C.	A Att. C502 C503 FRONT C504 C507	B Att. C607 C603 C604 C602		A vs sweep	10 ms	1. Adjust C503 to obtain flat top.
	Same	5 v	+D.C.				A vs sweep	10 ms	2. Adjust C504 to obtain flat top.
	Same	50 v	+D.C.				A vs sweep	10 ms	3. Check for flat top on this range.
B Attenuator Compensation							B vs sweep		Repeat procedure for A Preamplifier using B Preamplifier controls and adjustments.
A Preamplifier Input Capacity (Adjustment necessary only when external attenuator probe is used)	H.P. 211A 2 kc into probe Full scale deflection	200 mv	+D.C.				A vs sweep	10 ms	1. Set square wave to approximately full scale and compensate external attenuator probe for best squarewave response.
		500 mv	+D.C.				A vs sweep	10 ms	2. Adjust C502 to obtain flat top.
		5 v	+D.C.				A vs sweep	10 ms	3. Adjust C507 to obtain flat top.
B Preamplifier Input Capacity							B vs sweep		Repeat procedure for A Preamplifier using B Preamplifier controls and adjustments.
A Preamplifier Common Mode Rejection	Ball. Prec. Cal. 1 v p-p common mode (gnd. link off)	10 mv	+D.C.				A vs sweep	10 ms	1. Adjust common mode adjustment until deflection is minimum. Should be less than 1 cm.
			+A.C.				A vs sweep	10 ms	2. Check to see that deflection is less than 1 cm.
B Preamplifier Common Mode Rejection							B vs sweep		Repeat procedure for A Preamplifier using B Preamplifier controls and adjustments.

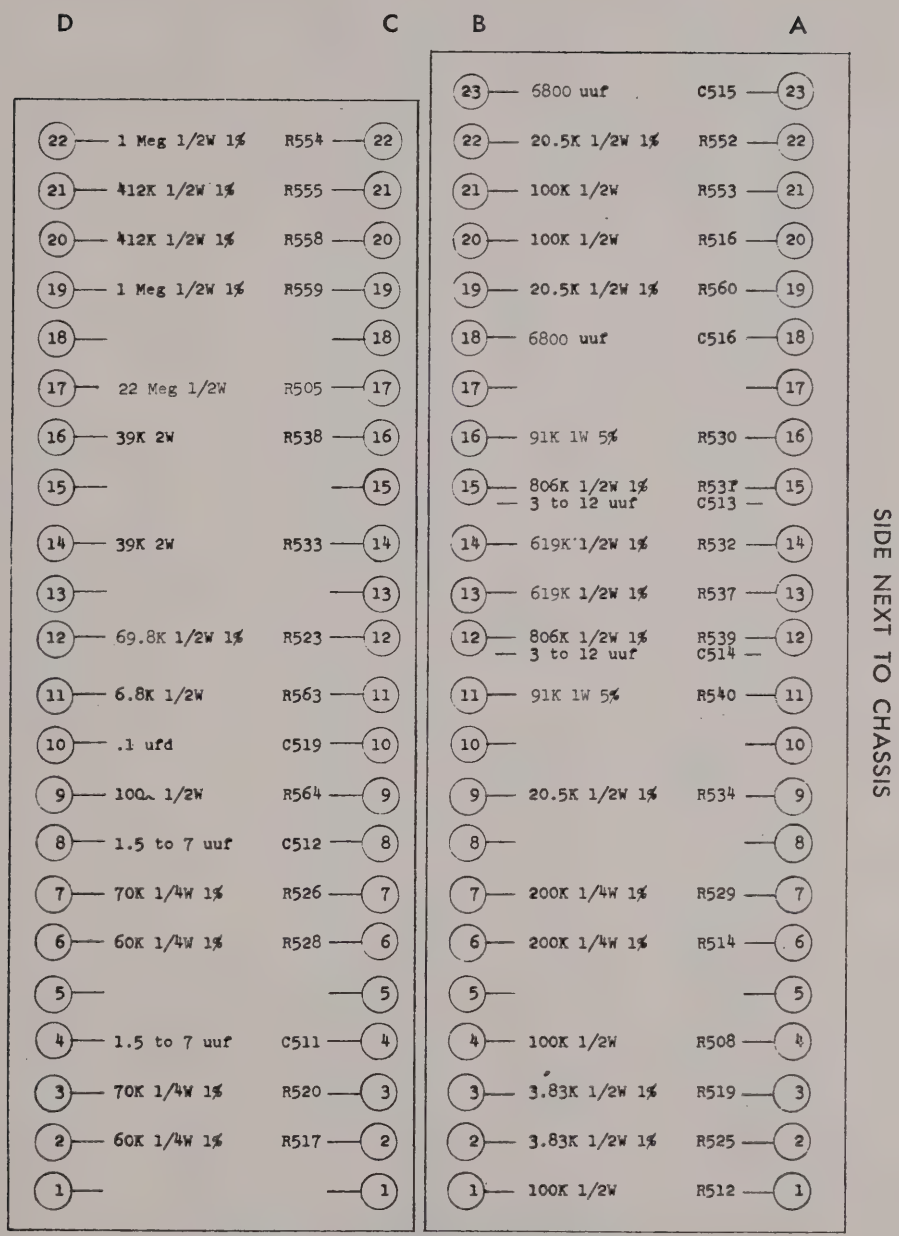
A AND B PREAMPLIFIERS (Continued)

Test	A Input	A Volts Full Scale Attenuator	A Selector	B Input	B Volts Full Scale Attenuator	B Selector	Display Function	Sweep Time	Observation and/or Adjustment
Check of Calibrator Accuracy	Gnd. link off. .01v Int. Cal. Sig. into upper terminal .01v p-p Ball. into lower terminal	10 mv	+D.C.				A vs sweep	100 ms	1. At the center of the pattern there will be a pair of parallel lines. The separation between these lines should be less than 1 mm.
		100 mv	+D.C.				A vs sweep	100 ms	2. Repeat above with 100 mv signals.
A Preamplifier Grid Current Adjustment	Shorted	1 mv					A vs sweep	100 ms	1. Short C500A (lower. 02 µf cap. on A selector). 2. Switch A selector between +D.C. and +A.C. and vary grid current adjustment until there is no offset between the two positions.
B Preamplifier Grid Current Adjustment							B vs sweep		Repeat above for B Preamplifier.
A Preamplifier Null Readout Adjustment	Ball. Prec. Cal. 100 mv p-p 200 mv	200 mv	+A.C.				A vs sweep	10 ms	1. Turn inner shaft of switch fully clockwise and loosen A Readout knob and dial. 2. Set knob and dial so that the 2.85 mark on the readout dial is aligned with the right edge of the lower extension of the fiducial (below the large volt range knob). 3. Set readout dial at midscale (2.5) and align lower tips of calibrator signal with the center horizontal scale line. 4. Turn readout dial counter clockwise to 5 and adjust A readout adjustment until tops of signal align to center horizontal line. 5. Repeat steps 3 and 4 until no more adjustment is required. 6. Set readout dial to midscale and align upper tips of signal with the center horizontal line. 7. Turn readout dial to zero and check that lower tips of signal align with the center horizontal line. 8. Check readout for full scale (200 mv) signal.
B Preamplifier Readout				Ball. Prec. Cal. 100 mv p-p	200 mv	+A.C.	B vs sweep		Repeat procedure for A readout using B channel controls and adjustments.

INTERNAL SYNC COMPENSATION

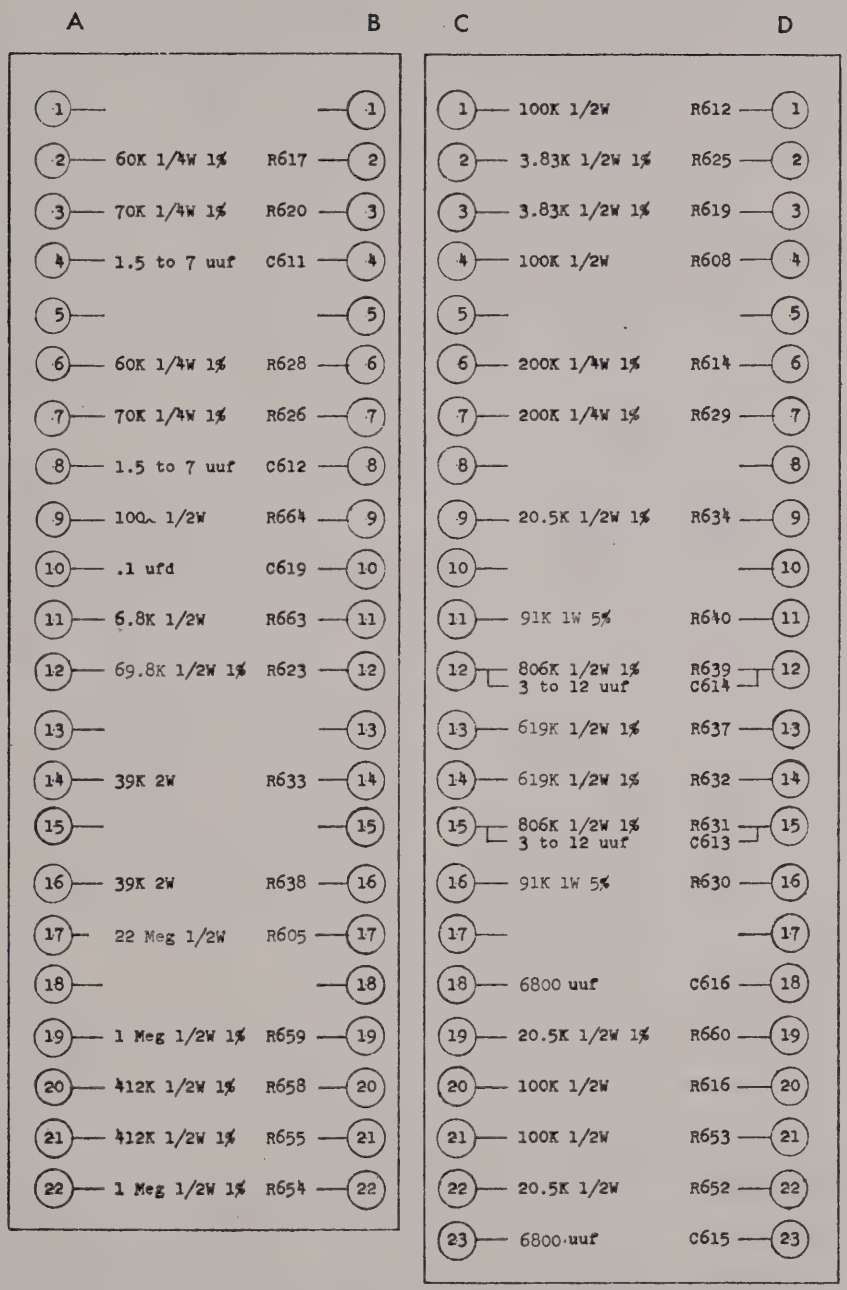
With Internal AC sync, the Level Control centered, the Sweep Mode in Driven Variable Length, and the Length control in preset, make the internal sync compensation adjustment as follows: With full scale 5 k.c. squarewave on amplifier, observe squarewave at Pin 6 V701 with Analab Type 1100/700 scope or equivalent. Adjust Internal Sync Comp. trimmer to compensate squarewave for optimum shape. Trimmer is located on terminal board below sweep chassis.

4-7. TERMINAL BOARD LAYOUT



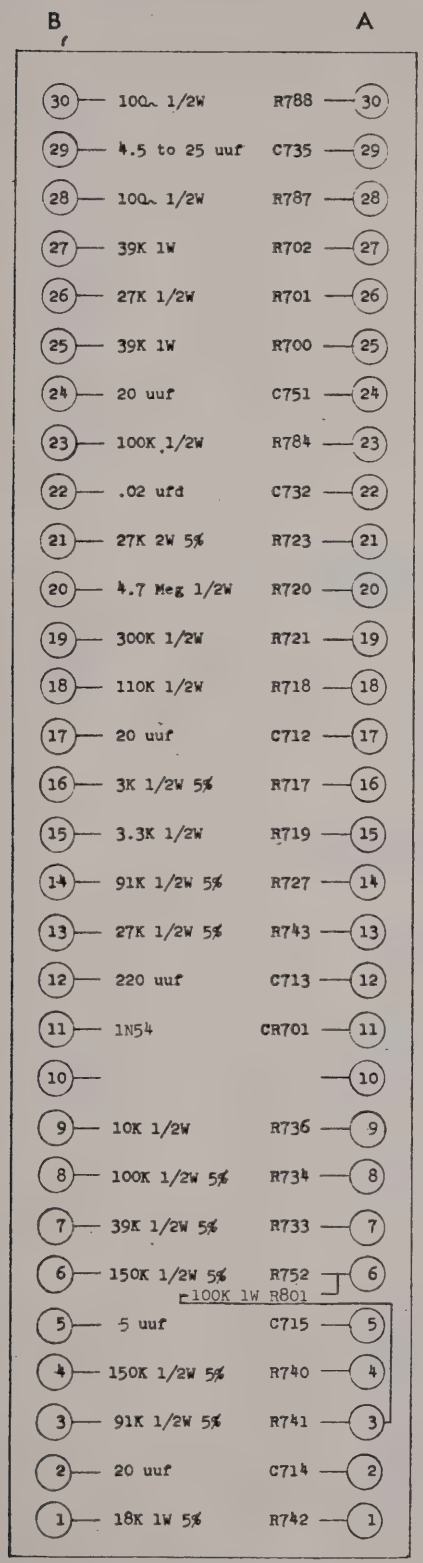
TB501 A PRE-AMPLIFIER 850 000 005

4-7. TERMINAL BOARD LAYOUT (Continued)

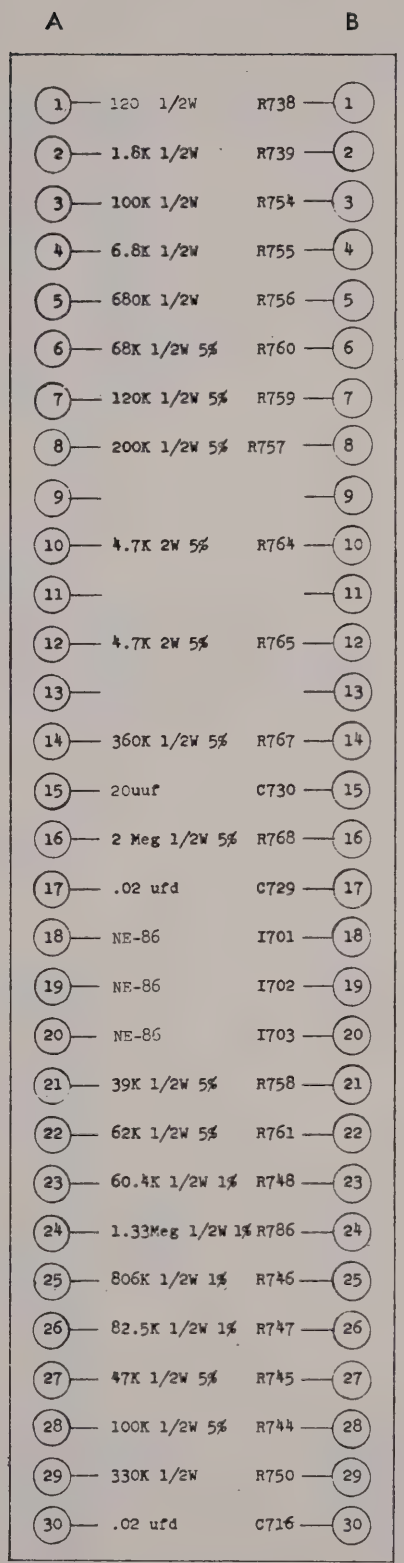


TB601 B PRE-AMPLIFIER 850 000 006

4-7. TERMINAL BOARD LAYOUT (Continued)



TB702 SWEEPBOARD
850 000 004



TB701 SWEEPBOARD
850 000 003

4-8. REPLACEMENT PARTS

VENDOR CODE

AB	Allen Bradley
AMP	Amperite
ANA	Analab
AU	Automatic
AX	Amperex
BL	Bussman, Littlefuse
BX	Bendix
CE	Centralab
CG	Corning Glass
CJ	Cinch Jones
CL	Clarostat
CTS	Chicago Telephone Supply
EM	El Menco
ER	Erie
GA	Grigsby Allison
GE	General Electric
GU	Gudeman
HH	HH Smith
IRC	International Resistance Co.
OR	Ortron
RCA	RCA
RGTS	RCA, GE, Tung-Sol, Sylvania
PO	Potter
PY	Pyramid
SO	Sangamo
SP	Sprague
ST	Stackpole
SY	Sylvania
SZ	Sarkes Tarzian
TI	Texas Instruments
TR	Transitron
WL	Ward Leonard
WI	Wirt

DESCRIPTION CODE

CE	Capacitor Electrolytic
CFGP	Capacitor Fixed General Purpose
CFM	Capacitor Fixed Miscellaneous
CFP	Capacitor Fixed Precision
CVC	Capacitor Ceramic Variable
RFC	Resistor Fixed Composition
RFF	Resistor Fixed Film
RFM	Resistor Fixed Metal Film
RFW	Resistor Wire Wound
RVC	Resistor Variable Composition
RVWW	Resistor Variable Wire Wound
SA	Same As

REPLACEMENT PARTS

RESISTORS

Symbol	Description	Vendor	Analab Part No.
R500	RFC ½W 5% 20M	AB	021 472 061
R501	RFF ½W ½% 249K	CG	034 424 961
R502	RFF ½W ½% 18.4K	CG	034 418 451
R503	RFF ½W ½% 2.02K	CG	034 420 241
R504	RFF ½W ½% 2M	TI	034 420 071
R505	RFC ½W 10% 22M	AB	021 482 261
R506	RVC 500 2W 30%	CTS	011 050 101
R507	RFC ½W 10% 220K	AB	021 482 241
R508	RFC ½W 10% 100K	AB	021 481 041
R509	RFF ½W 1% 2M	TI	034 520 071
R510	RVC 250K ¼W 20%	CTS	011 125 401
R511	SA R509		
R512	SA R508		
R513	SA R507		
R514	RFM ½W 1% 200K	IRC	044 520 061
R517	RFM ½W 1% 60K	IRC	044 560 051
R518	RVC 500 ¼W 20%	CTS	011 150 101
R519	RFF ½W 1% 3.83K	CG	034 538 341
R520	RFM ½W 1% 70K	IRC	044 570 051
R521			
R522	RVC Backlash Front 50K 20%, Rear 1K 20%	CTS	010 000 700
R523	RFM ½W 1% 69.8K	IRC	044 569 851
R524	RFM ½W 1% 1.80K	IRC	044 518 041
R525	SA R519		
R526	SA R520		
R527	RVC 5000 ¼W 20%	CTS	011 150 201
R528	SA R517		
R529	SA R514		
R530	RFF 1W 5% 91K	CG	035 791 051
R531	RFM ½W 1% 806K	IRC	044 580 661
R532	RFM ½W 1% 619K	IRC	044 561 961
R533	RFC 2W 10% 39K	AB	021 683 931
R534	RFF ½W 1% 20.5K	CG	034 520 551
R536	RFC ½W 10% 15K	AB	021 481 531
R537	SA R532		
R538	SA R533		
R539	SA R531		
R540	SA R530		
R541	SA R536		
R542	RVC Dual 30K/30K 20% ¼W	CTS	010 000 400
R543	RFF ½W ½% 750	CG	034 475 031
R544	RFF ½W ½% 1.5K	CG	034 415 041
R545	RFF ½W ½% 4.5K	CG	034 445 041
R546	RFF ½W ½% 7.5K	CG	034 475 041
R547	SA R544		
R548	SA R543		
R549	SA R544		
R550	SA R545		
R551	SA R546		
R552	SA R534		
R553	SA R508		
R554	RFM ½W 1% 1M	IRC	044 510 071
R555	RFM ½W 1% 412K	IRC	044 541 261
R556	RVWW 10K 5%	CL	012 050 201
R557	RVC 50K ¼W 20%	CTS	011 150 301
R558	SA R555		
R559	SA R554		
R560	SA R534		
R561	SA R508		
R563	RFC ½W 10% 6.8K	AB	021 486 821
R564	RFC ½W 10% 100	AB	021 481 011
R565	RFC 2W 10% 27	AB	021 682 701

Symbol	Description	Vendor	Analab Part No.
R566	RFC ½W 10% 560K	AB	021 485 641
R567	RFC ½W 10% 5.6K	AB	021 485 621
R600	SA R500		
R601	SA R501		
R602	SA R502		
R603	SA R503		
R604	SA R504		
R605	RFC ½W 10% 22M	AB	021 482 261
R606	SA R506		
R607	SA R507		
R609	SA R509		
R610	SA R510		
R611	SA R509		
R613	SA R507		
R614	SA R514		
R617	SA R517		
R618	SA R518		
R619	SA R519		
R620	SA R520		
R621	SA R521		
R622	SA R522		
R623	SA R523		
R624	SA R524		
R625	SA R519		
R626	SA R520		
R627	SA R527		
R628	SA R517		
R629	SA R514		
R630	SA R530		
R631	SA R531		
R632	SA R532		
R633	SA R533		
R634	SA R534		
R636	SA R536		
R637	SA R532		
R638	SA R533		
R639	SA R531		
R640	SA R530		
R641	SA R536		
R642	SA R542		
R643	SA R543		
R644	SA R544		
R645	SA R545		
R646	SA R546		
R647	SA R544		
R648	SA R543		
R649	SA R544		
R650	SA R545		
R651	SA R546		
R652	SA R534		
R653	SA R508		
R654	SA R554		
R655	SA R555		
R656	SA R556		
R657	SA R557		
R658	SA R555		
R659	SA R554		
R660	SA R534		
R661	SA R508		
R663	SA R563		
R664	SA R564		
R666	SA R566		
R667	SA R567		
R700	RFC 1W 10% 39K	AB	021 583 931
R701	RFC ½W 10% 27K	AB	021 482 731
R702	SA R700		
R703	RVC 10K ½W 20%	CTS	011 110 302
R704	RFC 2W 5% 24K	AB	021 672 431
R705	RFC ½W 10% 2.2M	AB	021 482 251
R706	RFC ½W 10% 56K	AB	021 485 631
R707	SA R508		
R708	RFC ½W 10% 390K	AB	021 483 941
R709	RVC 50K ¼W 20%	CTS	011 150 302
R710	SA R507		
R711	SA R566		
R712	SA R507		
R713	SA R705		
R714	SA R508		
R715	SA R706		
R716	SA R566		
R717	RFC ½W 5% 3K	AB	021 473 021
R718	RFC ½W 5% 110K	AB	021 471 141
R719	RFC ½W 10% 3.3K	AB	021 483 321
R720	SA R505		
R721	RFC ½W 5% 300K	AB	021 473 041
R722	SA R527		
R723	RFC 2W 5% 27K	AB	021 672 731
R724	RFC ½W 10% 1M	AB	021 481 051
R725	SA R508		
R726	RFC ½W 10% 33K	AB	021 483 331
R727	RFC ½W 5% 91K	AB	021 479 131
R728	SA R557		
R729	SA R556		
R730	SA R509		
R731	SA R527		
R732	RFF ½W 1% 8.87K	CG	034 588 741
R733	RFC ½W 10% 39K	AB	021 483 931
R734	SA R508		
R735	SA R557		
R736	RFC ½W 10% 10K	AB	021 481 031
R737	RFC 1W 5% 15K	AB	021 571 531
R738	RFC ½W 10% 120	AB	021 481 211
R739	RFC ½W 10% 1.8K	AB	021 481 821
R740	RFC ½W 5% 150K	AB	021 471 541
R741	SA R727		
R742	RFC 1W 5% 18K	AB	021 571 831
R743	RFC ½W 5% 27K	AB	021 472 731
R744	RFC ½W 5% 100K	AB	021 471 041
R745	RFC ½W 5% 47K	AB	021 474 731
R746	SA R531		
R747	RFF ½W 1% 82.5K	CG	034 582 551
R748	RFF ½W 1% 60.4K	CG	034 560 451
R749	SA R706		
R750	RFC ½W 10% 330K	AB	021 483 341
R751	SA R705		
R752	SA R740		
R753	RFC ½W 5% 39K	AB	021 473 931
R754	SA R508		
R755	SA R563		
R756	RFC ½W 10% 680K	AB	021 486 841
R757	RFC ½W 5% 200K	AB	021 472 041
R758	SA R753		
R759	RFC ½W 5% 120K	AB	021 471 241
R760	RFC ½W 5% 68K	AB	021 476 831
R761	SA R733		
R762	RFF ½W 1% 27.4K	CG	034 527 451
R763	RFF ½W 1% 30.1K	CG	034 530 151
R764	RFC 2W 10% 4.7K	AB	021 684 721
R765	SA R764		
R766	RFC 2W 10% 56K	AB	021 685 631
R767	RFC ½W 5% 360K	AB	021 473 641
R768	RFC ½W 5% 2M	AB	021 472 051
R769	RFC 1W 10% 390K	AB	021 593 941
R770	RFF ½W 1% 143K	CG	034 514 361
R771	SA R527		
R772	RFF ½W 1% 137K	CG	034 513 761
R773	RFC ½W 10% 4.7K	AB	021 484 721
R774	RVC Dual Front & Rear 100K 20%	CTS	010 000 300
R775	RFC ½W 10% 56K	AB	021 485 631
R776	RVC 10K ½W 20%	CTS	011 110 302
R777	RFF ½W ½% 1.62M	TI	034 416 271
R778	SA R777		
R779	RFF 1W ½% 4.87M	TI	035 448 771
R780	SA R557		
R781	RFF 2W 1% 48.7M	TI	036 548 781
R782	RFF 2W 1% 16.2M	TI	036 516 281
R783	SA R582		
R784	RFF 2W 10% 220K	CG	036 822 061
R785	RFC ½W 10% 220	AB	021 482 211

Symbol	Description	Vendor	Analab Part No.
R786	RFM ½W 1% 1.33M	IRC	044 513 371
R787	SA R564		
R788	SA R564		
R789	SA R564		
R790	SA R508		
R791	RFF ½W ½% 102	CG	034 410 231
R792	RFF ½W ½% 11.3	CG	034 411 321
R793	RFC ½W 10% 150K	AB	021 481 541
R794	SA R706		
R795	RFC ½W 10% 270K	AB	021 482 731
R796	SA R508		
R797	RFC ½W 10% 10M	AB	021 481 061
R798	RFC ½W 10% 22M	AB	021 482 261
R799	RFC ½W 10% 1K	AB	021 481 021
R800	RFC ½W 10% 1K	AB	021 481 021
R801	RFC 1W 10% 100K	AB	021 581 041
R802	RFC ½W 10% 390K	AB	021 483 941
	CAPACITORS		
C500 } C501 }	A&B CFP Polystyrene 10% .02µf Supplied in Matched Pairs	GU	081 820 502
C502	CVC 3-12 µµf	ER/CE	073 122 001
C503	CVC 4.5-25 µµf	ER/CE	073 252 001
C504	SA C503		
C505	CFP Mica 5% 130 µµf	EM	082 713 301
C506	CFP Mica 5% 1500 µµf	EM	082 715 401
C507	SA C502		
C508	CFP Paper 10% .005µf	EM	086 850 401
C509	SA C508		
C511	CVC 1.5-7 µµf	ER/CE	073 701 001
C512	SA C511		
C513	SA C502		
C514	SA C502		
C515	CFP Mylar 10% 6800 µµf	PY	088 868 401
C516	SA C515		
C517	CFP Ceramic 20% 5 µµf	ER	084 950 301
C518	SA C517		
C519	CFP Met. Mylar 20% .1 µf 200V	PO	089 910 601
C520	10 µµf 5%	EM	082 710 201
C521	.005 µf Ceramic	ER	112 650 401
C600	SA C500		
C602	SA C502		
C603	SA C503		
C604	SA C503		
C605	SA C505		
C606	SA C506		
C607	SA C502		
C608	SA C508		
C609	SA C509		
C611	SA C511		
C612	SA C511		
C613	SA C502		
C614	SA C502		
C615	SA C515		
C616	SA C515		
C617	SA C517		
C618	SA C517		
C619	SA C519		
C620	SA C520		
C621	SA C521		
C700	CFGP Ceramic .02 µf 500V	ER	112 620 501
C701	SA C700		
C702	CFGP Ceramic .005 500V	ER	112 650 401
C703	SA C700		
C704	SA C702		
C706A, B	CE 10 µf 450V Dual	SP	092 000 001
C707	SA C700		
C709			
C710	SA C700		
C711	CFGP Ceramic .001 500V	ER	112 610 401
C712	CFP Mica 5% 20 µµf	EM	082 720 201
C713	CFP Mica 5% 220 µµf	EM	082 722 301
C714	SA C712		
C715	CFP Mica 5% 5 µµf	EM	082 750 101
C716	SA C700		
C717	CFP Mica 5% 10 µµf	EM	082 710 201
C718	SA C702		
C720	SA C715		
C721	CFP Polystyrene 5% 1.01 µf	GU	081 710 701
C722	SA C502		
C723	SA C503		
C724	CFP Mica 5% 91 µµf	EM	082 791 201
C725	CFP Mica ½% 1000 µµf	EM	082 410 401
C726	CFP Polystyrene 1% .0109 µf	GU	081 510 501
C727	CFP Polystyrene 1% .109 µf	GU	081 510 601
C728	CFP Mica 5% 82 µµf	EM	082 782 201
C729	SA C700		
C730	CFP Mica 5% 20 µµf	EM	082 720 201
C731	SA C700		
C732	SA C700		
C733	SA C505		
C734	SA C702		
C735	SA C503		
C736	SA C521		
C751	SA C712		
	INDUCTORS		
L700	Inductor, Fixed, Ferrite, 620 µh	ANA	153 562 301
	TUBES		
V501	Tube Electron, 6AU6	AX	200 576 301
V502	SA V501		
V503	Tube Electron 12AT7	RGTS	203 394 303
V504	SA V503		
V505	Tube Electron 12AX7	RGST	203 394 304
V601	SA V501		
V602	SA V501		
V603	SA V503		
V604	SA V503		
V605	SA V505		
V701	Tube Electron, 6BK7-B	RGTS	203 396 301
V702	SA V701		
V703	SA V701		
V704	SA V701		
V705	Tube Electron 6AW8-A	RGTS	203 596 302
V706	Tube Electron 12AU7	RGTS	203 394 301
V707	Tube Electron 6BC7	RGTS	202 696 101
	SEMICONDUCTORS		
CR700	Semi Conductor Diode 1N34A	ER, SY	233 300 341
CR701	Semi Conductor Diode 1N54A	ER, SY	233 300 541
CR702			
	LAMPS		
I501	Lamp Incandescent #12	GE	251 437 001
I601	SA I501		
I700	SA I501		
I701	Lamp Neon NE86	GE	252 055 003
I702	SA I701		
I703	SA I701		
I704	SA I701		
I705	SA I501		
I706	Lamp Neon NE2	GE	252 055 002
	SWITCHES		
S501	Switch Rotary A/B Selector	ANA	270 000 006
S502	Switch Rotary A/B Attenuator	ANA	270 000 001
S503	Switch, Slide, DPDT	ST	271 020 201
S601	SA S501		
S602	SA S502		
S603	SA S503		
S700	Switch Rotary Sync Selector	ANA	270 000 002
S701	Switch Rotary Sweep Time	ANA	270 000 000
S702	Switch Rotary Sweep Mode	ANA	270 000 003
S703	Switch, Push, Non-Latching Manual Trigger	WI	271 020 203
S704	SA S503		
	TERMINAL BOARDS		
TB501	Terminal Board Assembly A Preamp	ANA	850 000 005
TB601	Terminal Board Assembly B Preamp	ANA	850 000 006
TB701	Terminal Board, Assembly Sweep	ANA	850 000 003
TB702	Terminal Board, Assembly Sweep	ANA	850 000 004

4-9. TYPE 500 HIGH-GAIN X-Y PLOTTER

The Type 500 is designed for those applications requiring high-gain, stable amplifiers for X-Y plots. The parent Type 700 is a modularized plug-in consisting of three basic modules, the A preamplifier, B preamplifier, and trigger and sweep. In the Type 500 the circuitry of the trigger and sweep module is omitted. All other specifications and performance characteristics of the Type 500 are identical to those of the Type 700. Hence, no separate parts listing or schematics are required.

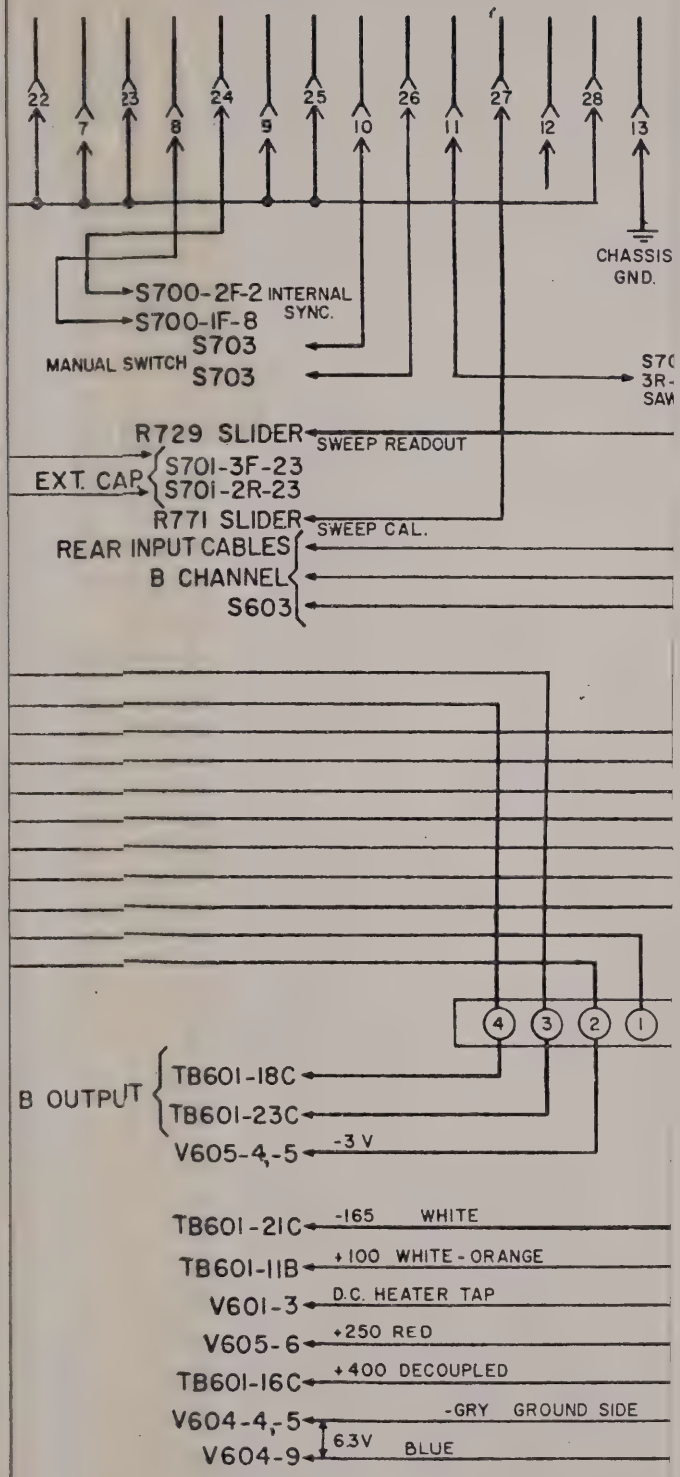
4-10. TYPE 600 DUAL-CHANNEL PLUG-IN

In contrast to the Type 700 where the A and B channels have identical high-gain amplifiers, the Type 600 has the same A preamplifier, but provides somewhat less sensitivity in the B channel. The trigger and sweep modules of the Types 600 and 700 are identical.

The maximum sensitivity of the B channel, operated with the main frame, is 40 mv/cm. The sensitivity is varied by an uncalibrated 250 k potentiometer. Single-ended or balanced input is provided. The signals on either the A or B channels may be plotted against time or each other by proper positioning of the Display Function Switch in the main frame. The bandwidth of the B channel is DC to approximately 500 kc when the gain control is fully clockwise. The bandwidth is reduced as this control is rotated for lower sensitivities.

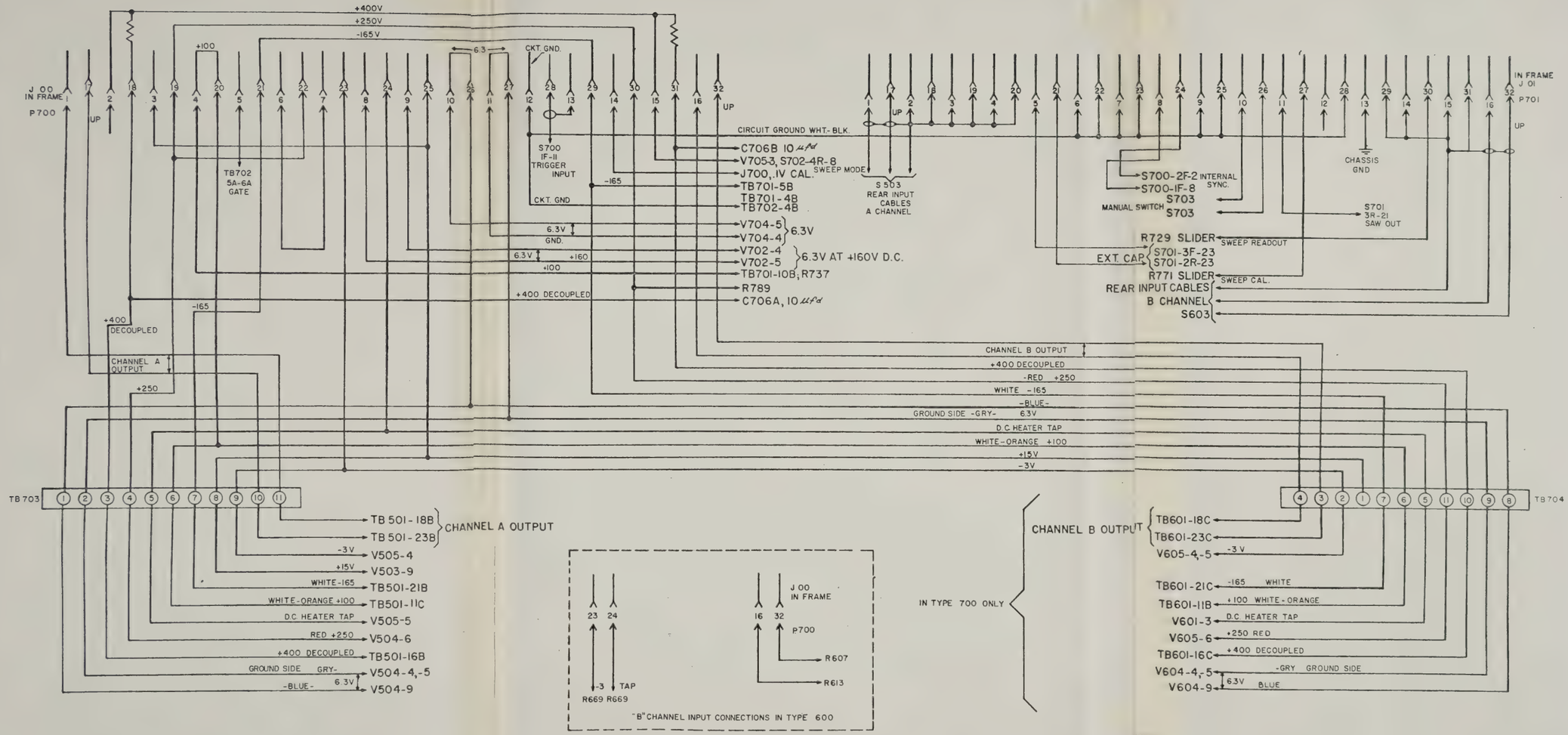
4-11. PARTS PECULIAR TO TYPE 600

Symbol	Description	Vendor	Analab Part No.
R668	RVC Dual 1W 250K/250K 20%	CTS	010 000 500
R669	RFW 10W 10% 30	WL/SP	059 830 030
R670	RFC ½W 10% 56K	AB	021 485 631
R671	RFC ½W 10% 56K	AB	021 485 631
C622	SA C700		
C623	SA C700		



CHANGES:

1. V702 Heater at +125V, not +160V.



CHANGES:

1. V702 Heater at +125V, not +160V.

CABLE ASSEMBLY, PLUG-IN

Drawing No. 877 000 001

CHANNELS A AND B HIGH-GAIN PREAMPLIFIERS

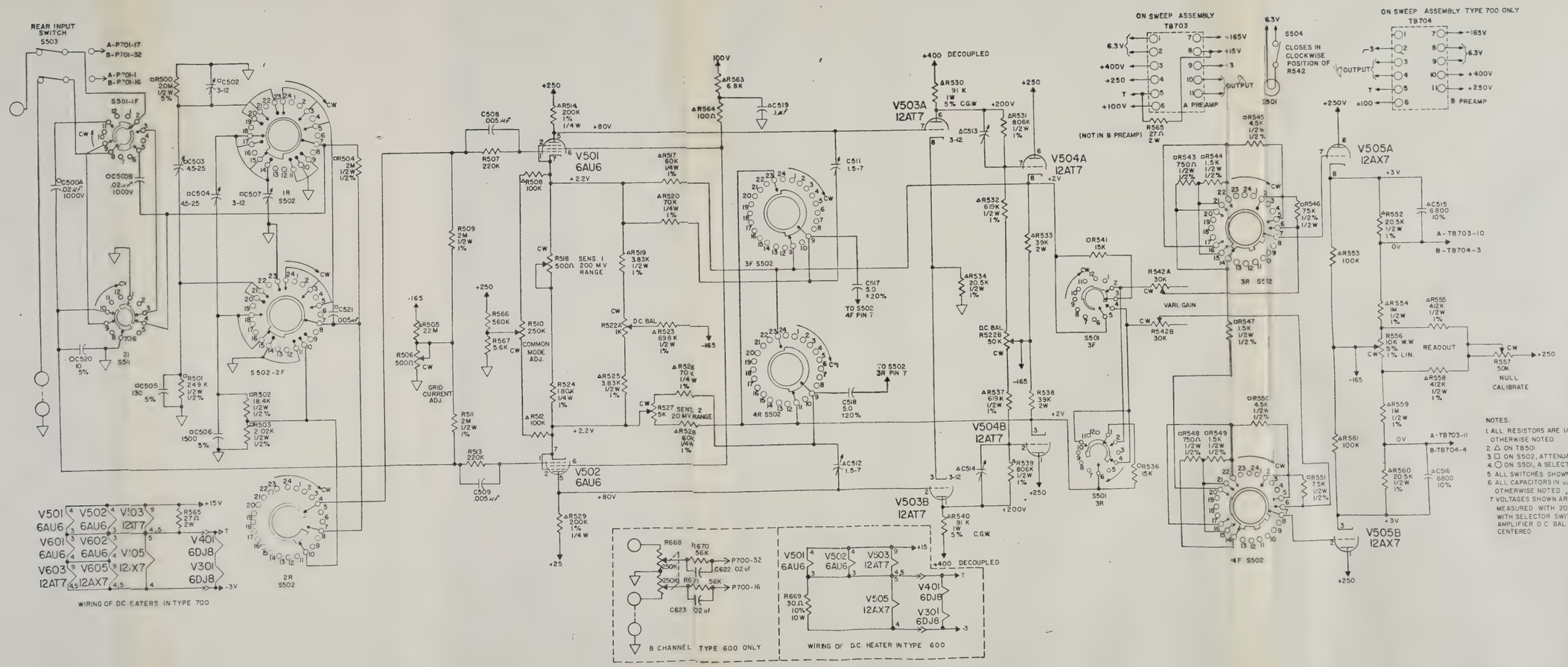
SYMBOL NUMBERS SHOWN ARE FOR A PREAMPLIFIER. FOR B PREAMPLIFIER, ALL SYMBOL NUMBERS CHANGE TO 600 SERIES.

Drawing No. 907 001 000

CHANNELS A AND B HIGH-GAIN PREAMPLIFIERS

SYMBOL NUMBERS SHOWN ARE FOR A PREAMPLIFIER. FOR B PREAMPLIFIER, ALL SYMBOL NUMBERS CHANGE TO 600 SERIES.

Drawing No. 907 001 000

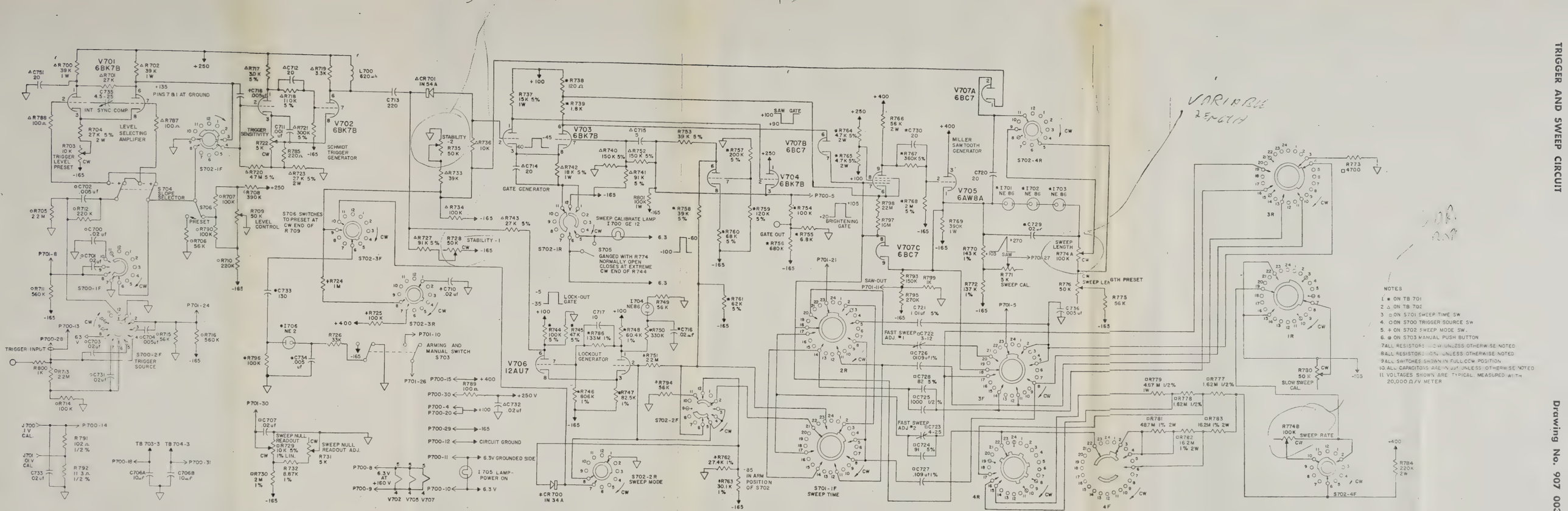


NOTES:

1. ALL RESISTORS ARE 1/2 W, 10%, UNLESS OTHERWISE NOTED.
2. △ ON T850I
3. □ ON S502, ATTENUATOR SWITCH
4. ○ ON S501, A SELECTOR SWITCH
5. ALL SWITCHES SHOWN IN C.C.W. POSITION
6. ALL CAPACITORS IN μμf UNLESS OTHERWISE NOTED.
7. VOLTAGES SHOWN ARE TYPICAL, MEASURED WITH 20,000Ω / V METER WITH SELECTOR SWITCH ON BAL POSITION, AMPLIFIER D.C. BAL., AND TRACE CENTERED

TRIGGER AND SWEEP CIRCUIT

Drawing No. 907 003 000


TRIGGER AND SWEEP CIRCUIT
Drawing No. 907 003 000
V701 6BK7B
V702 6BK7B
V703 6BK7B
V704 6BK7B
V705 6AW8A
V706 12AU7
V707A 6BC7
V707B 6BC7
V707C 6BC7
LEVEL SELECTING AMPLIFIER
INT SYNC COMP
TRIGGER SENSITIVITY
SCHMIDT TRIGGER GENERATOR
TRIGGER LEVEL PRESET
S704 SLOPE SELECTOR
S706 SWITCHES TO PRESET AT CW END OF R709
PRESET
LEVEL CONTROL
GATE GENERATOR
SWEEP CALIBRATE LAMP I700 GE 12
S705 GANGED WITH R774 NORMALLY OPEN CLOSES AT EXTREME CW END OF R744
BRIGHTENING GATE
GATE OUT
MILLER SAWTOOTH GENERATOR
SWEEP LENGTH R774A 100K
SWEEP LENGTH PRESET
SAW-OUT
LOCK-OUT GATE
LOCKOUT GENERATOR
FAST SWEEP ADJ #1
FAST SWEEP ADJ #2
ARMING AND MANUAL SWITCH S703
TRIGGER INPUT
TRIGGER SOURCE
SWEEP NULL READOUT ADJ.
SWEEP NULL READOUT
I705 LAMP-POWER ON
6.3V GROUNDED SIDE
CIRCUIT GROUND
+400
+250 V
+100
-165
6.3 V
+160 V
S702-1F
S702-2F SWEEP MODE
S701-1F SWEEP TIME
S702-2R
S702-3F
S702-3R
S702-4R
S702-4F
SLOW SWEEP CAL.
SWEEP RATE
VARIABLE LENGTH
NOTES
1 ✱ ON TB 701
2 △ ON TB 702
3 □ ON S701 SWEEP TIME SW
4 ○ ON S700 TRIGGER SOURCE SW
5 + ON S702 SWEEP MODE SW.
6 ⊕ ON S703 MANUAL PUSH BUTTON
7 ALL RESISTORS 1/2 W UNLESS OTHERWISE NOTED
8 ALL RESISTORS ±5% UNLESS OTHERWISE NOTED
9 ALL SWITCHES SHOWN IN FULL CCW POSITION
10 ALL CAPACITORS ARE IN μμf UNLESS OTHERWISE NOTED
11 VOLTAGES SHOWN ARE TYPICAL, MEASURED WITH 20,000 Ω/V METER
CHANGES
1. V707 is a 6BJ7.
2. R802 390K is connected from plate of V707B to +250V
3. R771 is 10K.
4. Short erroneously shown across Lugs 2 and 4 of S701-4F.
5. Heaters of V702, V705, V707 are at 6.3V at +125V, not +165V.
6. R704 is 24K.

SECTION V
WARRANTY AND REPAIRS

5-1. CLAIM FOR DAMAGE IN SHIPMENT

If the instrument is damaged in any way or fails to operate upon arrival, a claim should be filed with the carrier. A full report of the damage should be obtained from the claim agent and a copy forwarded to Analab. We will assist as much as possible in helping you settle the claim and arrange for repair or replacement. Please include type and serial numbers when referring to this equipment for any reason.

5-2. WARRANTY

Analab Instrument Corporation warrants for a period of one year after delivery to the original purchaser that each instrument it manufactures is free from defects in material or workmanship. (Power transformers manufactured by or for Analab carry a five year warranty.) Repairs or service under warranty will be made when the instrument has been returned to Analab or one of its authorized service depots, transportation charges prepaid, by the original purchaser, and when, upon our examination, it is determined to our satisfaction to be defective. Liability under this warranty is limited to service or adjustment of any instrument returned to the factory or authorized service depot and to replacement of any defective parts. If the defect has been caused by misuse or abnormal conditions of operation, repairs will be billed at normal service rates, but an estimate will be submitted for approval before work is started.

5-3. RETURNING INSTRUMENTS FOR REPAIR, IN OR OUT OF WARRANTY

If any malfunction develops, please take the following steps:

A.—Send full details of the fault and include type and serial numbers. Upon receipt of this information we will send you service instructions or shipping instructions to return the instrument to Analab or one of its authorized service depots.

B.—If the instrument is to be shipped to us or a service depot, forward it transportation prepaid. If requested, an estimate of the charges will be made before the work begins in those cases where the instrument is not covered by warranty.

5-4. PACKING

Whenever possible, return the instrument in its original carton and packing. If such is no longer available, pack the instrument in a strong exterior container. The instrument should be surrounded with excelsior or similar shock-absorbing material.

ANALAB INSTRUMENT CORPORATION

30 Canfield Road

Cedar Grove, Essex County, N. J., U.S.A.

AREA CODE 201 — CE 9-6500

Cable Address: ANALAB